

What is claimed is:

- 5
1. A nonwoven filter media composite comprising glass wool fibers essentially free of boron and chopped glass fibers ~~essentially free of boron~~, wherein said chopped glass fibers are interspersed throughout said glass wool. +1P
2. The filter media composite of claim 1, wherein said glass wool fibers contain less than about 0.2% by weight boron oxide.
3. The filter media composite of claim 1, wherein said chopped glass fibers contain less than 1.0% by weight boron oxide.
4. The filter media composite of claim 1, wherein said glass wool fibers have an average diameter between about 0.1 microns and about 5.0 microns.
5. The filter media composite of claim 4, wherein said glass wool fibers have an average diameter of between about 0.4 microns and about 1.0 microns.
6. The filter media composite of claim 1, wherein the length to diameter (l/d) of said glass wool fibers is between about 100 to about 10,000.
7. The filter media composite of claim 6, wherein the length to diameter (l/d) of said glass wool fibers is about 300.
8. The filter media composite of claim 1, wherein the chopped glass fibers have an average diameter of about 6.5 microns.
9. The filter media composite of claim 1, wherein the chopped glass fibers have an average length of between about a quarter of an inch to a half an inch.

007737109-31400

20

25

10. The filter media composite of claim 1, wherein said composite further includes a binder.

11. The filter media composite of claim 10, wherein said binder is between about 2  
5 and 10% by weight of said composite.

12. The filter media composite of claim 11, wherein said binder is between about 3  
and 9% by weight of said composite.

13. The filter media composite of claim 10, wherein said binder is an styrene-acrylic  
binder.

14. The filter media composite of claim 1, wherein said composite further includes a  
water repellent.

15. The filter media composite of claim 14, wherein said water repellent is between  
about 0.01% and 5.0% by weight of said composite.

16. The filter media composite of claim 15, wherein said water repellent is between  
20 about 0.05% and about 3.0% by weight of said composite.

17. The filter media composite of claim 14, wherein said water repellent is a  
fluoroacrylate.

18. The filter media composite of claim 1, wherein said composite further includes a  
25 surfactant.

19. The filter media composite of claim 18, wherein said surfactant is between about  
1.5 x 10<sup>-5</sup>% and about 1.0% by weight of said composite.

20. The filter media composite of claim 18, wherein said surfactant is between about  $5 \times 10^{-5}$  and about 0.1% by weight of said composite.

21. The filter media composite of claim 1, wherein said chopped glass fibers have between about 55% and about 65%  $\text{SiO}_2$  by weight.

22. The filter media composite of claim 21, wherein said chopped glass fibers have between about 59% and about 60%  $\text{SiO}_2$  by weight.

23. The filter media composite of claim 1, wherein said chopped glass fibers have between about 10% and 15%  $\text{Al}_2\text{O}_3$  by weight.

24. The filter media composite of claim 23, wherein said chopped glass fibers have about 13%  $\text{Al}_2\text{O}_3$  by weight.

25. The filter media composite of claim 1, wherein said chopped glass fibers have between about 0% and less than about 1% boron by weight.

26. The filter media composite of claim 25, wherein said chopped glass fibers have less than about 0.6% boron by weight.

27. The filter media composite of claim 1, wherein said chopped glass fibers have less than about 1% iron oxides by weight.

28. The filter media composite of claim 27, wherein said chopped glass fibers have less than about 0.5% iron oxides by weight.

29. The filter media composite of claim 1, wherein said chopped glass fibers have less than about 2% sodium oxide by weight.

30. The filter media composite of claim 29, wherein said chopped glass fibers have less than about 1.0% sodium oxide by weight.

31. The filter media composite of claim 1, wherein said chopped glass fibers have less than about 3.0% potassium oxide by weight.

32. The filter media composite of claim 31, wherein said chopped glass fibers have less than about 0.5% potassium oxide by weight.

33. The filter media composite of claim 1, wherein said chopped glass fibers have between about 20% and about 25% calcium oxide by weight.

34. The filter media composite of claim 33, wherein said chopped glass fibers have between about 21% and about 23% sodium oxide by weight.

35. The filter media composite of claim 1, wherein said chopped glass fibers have less than about 5% magnesium oxide by weight.

36. The filter media composite of claim 35, wherein said chopped glass fibers have less than about 4.0% magnesium oxide by weight.

37. The filter media composite of claim 1, wherein said glass wool fibers have less than about 70%  $\text{SiO}_2$  by weight.

38. The filter media composite of claim 37, wherein said glass wool fibers have between about 62% and about 69%  $\text{SiO}_2$  by weight.

39. The filter media composite of claim 1, wherein said glass wool fibers have less than about 7%  $\text{Al}_2\text{O}_3$  by weight.

40. The filter media composite of claim 39, wherein said glass wool fibers have between about 2.5% and about 6.5%  $\text{Al}_2\text{O}_3$  by weight.
41. The filter media composite of claim 1, wherein said glass wool fibers have less than about 0.5% iron oxides by weight.
42. The filter media composite of claim 41, wherein said glass wool fibers have less than about 0.02% iron oxides by weight.
43. The filter media composite of claim 1, wherein said glass wool fibers have less than about 0.2% boron by weight.
44. The filter media composite of claim 43, wherein said glass wool fibers have less than about 0.08% boron by weight.
45. The filter media composite of claim 1, wherein said glass wool fibers have less than about 15% sodium oxide by weight.
46. The filter media composite of claim 45, wherein said glass wool fibers have between about 8.5% and about 12.5% sodium oxide by weight.
47. The filter media composite of claim 1, wherein said glass wool fibers have less than about 7% potassium oxide by weight.
48. The filter media composite of claim 47, wherein said glass wool fibers have between about 2.5% and about 7.0% potassium oxide by weight.
49. The filter media composite of claim 1, wherein said glass wool fibers have less than about 10.0% calcium oxide by weight.

50. The filter media composite of claim 49, wherein said glass wool fibers have between about 4.0% and about 6.0% calcium oxide by weight.

51. The filter media composite of claim 1, wherein said glass wool fibers have less than about 5% magnesium oxide by weight.

52. The filter media composite of claim 51, wherein said glass wool fibers have between about 2.5% and about 5.0% magnesium oxide by weight.

53. The filter media composite of claim 1, wherein said glass wool fibers have less than about 10% barium oxide by weight.

54. The filter media composite of claim 53, wherein said glass wool fibers have between about 0% and about 9.5% barium oxide by weight.

55. The filter media composite of claim 1, wherein said glass wool fibers have less than about 5% zinc oxide by weight.

56. The filter media composite of claim 55, wherein said glass wool fibers have between about 0.5 and about 3.0% zinc oxide by weight.

57. The filter media composite of claim 1, wherein said chopped glass fibers have between about 55% and about 65%  $\text{SiO}_2$ , between about 10% and 15%  $\text{Al}_2\text{O}_3$ , between about 0% and less than about 1% boron, less than about 1% iron oxides, less than about 2.0% sodium oxide, less than about 3.0% potassium oxide, between about 20% and 25% calcium oxide and less than about 5% magnesium oxide by weight, and wherein said glass wool fibers have less than about 70%  $\text{SiO}_2$  by weight, less than about 7%  $\text{Al}_2\text{O}_3$ , less than about 0.5% iron oxides, less than about 0.2% boron, less than about 15% sodium oxide, less than about 7% potassium oxide, less than about 10.0% calcium oxide, less than about 5% magnesium oxide, less than about 10% barium

oxide, and less than about 5% zinc oxide by weight.

58. The filter media composite of claim 57, wherein said chopped glass fibers make up between about 5% and about 40% of the total weight of said filter media composite.

5

59. The filter media composite of claim 1, wherein chopped glass fibers have between about 59% and about 60%  $\text{SiO}_2$ , about 13%  $\text{Al}_2\text{O}_3$ , less than about 0.6% boron, less than about 0.5% iron oxides, less than about 1.0% sodium oxide, less than about 0.5% potassium oxide, between about 21% and about 23% sodium oxide, 4.0% magnesium oxide by weight, and said glass wool fibers have between about 62% and about 69%  $\text{SiO}_2$ , between about 2.5% and about 6.5%  $\text{Al}_2\text{O}_3$ , less than about 0.2% iron oxides, less than about 0.08% boron, between about 8.5% and about 12.5% sodium oxide, between about 2.5% and about 7.0% potassium oxide, between about 4.0% and about 6.0% calcium oxide, between about 2.5% and about 5.0% magnesium oxide, between about 0% and about 9.5% barium oxide, and between about 0.5 and about 3.0% zinc oxide by weight.

60. The filter media composite of claim 59, wherein said chopped glass fibers make up between about 5% and about 40% of the total weight of said filter media composite.

20

61. The filter media composite of claim 1, wherein said chopped glass fibers make up between about 5% and about 40% of the total weight of said filter media composite.

62. The filter media composite of claim 1, wherein said chopped glass fibers make up between about 20% and about 25% of the total weight of said filter media composite.

25